

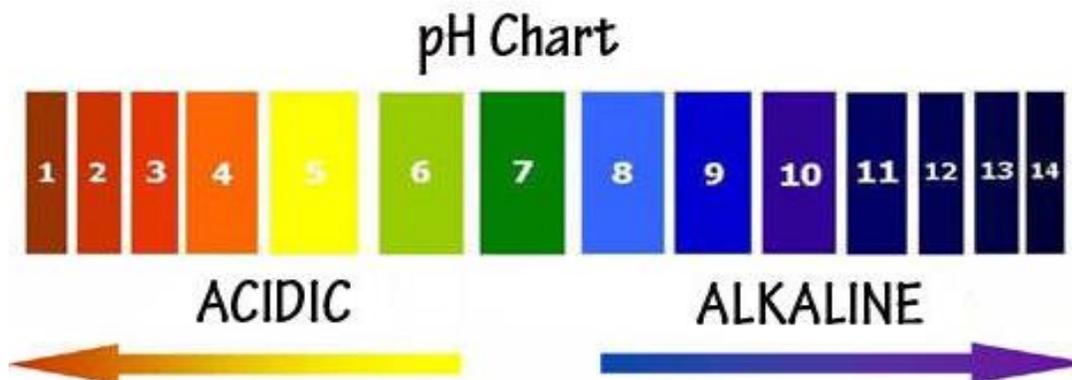


## LAB ACTIVITY: THE UPS AND DOWNS OF PH

Humans come in contact with acids and bases all the time-when cooking, cleaning and eating. Baking soda is *base* used in household cleaners. Vinegar is a weak form of acetic *acid* used in salad dressing acid. Citrus fruits contain citric acid and sodas are loaded with carbonic acid which is made when carbon dioxide combines with the water in your body. If you combine vinegar with baking soda a chemical reaction occurs with lots of fizzing and foaming that result from the interaction between the acid (vinegar) and the base (baking soda).

There are also acids in the human body. Hydrochloric acid is in your stomach and is used to digest food. The stomach acid has to be kept away from the rest of the body because it is very harsh and can cause serious damage. The lining of the stomach is especially built to survive an acidic environment.

The pH scale is used to classify substances as acids and bases. The scale goes from 0 to 14. Things that are acids have a pH number that is less than 7. The lower the number, the stronger the acid. Bases have pH values higher than 7. The higher the number, the stronger the base. An example of a strong base is drain cleaner or oven cleaner. Both strong acids and strong bases can be very harmful to your skin and tissues. Distilled water has a pH of 7, which is *neutral*.



## Student Sheet 2

Water is made of 2 hydrogen atoms and 1 oxygen atom. When water breaks apart, it can form hydrogen ions ( $H^+$ ) or hydroxide ions ( $OH^-$ ). Solutions are classified as acids or bases depending upon what kinds of ions they release. Acid solutions have lots of hydrogen ions present and basic solutions have lots of hydroxide ions present. For example, stomach acid has a pH of 2 or 3, which means that it is very acidic and has lots of hydrogen ions. The pH outside of your stomach is much closer to neutral. Most of the cells in living things cannot live in the presence of a strong acid. That is why it is important that the stomach acid stays in the stomach. The cells in the stomach lining replace themselves continually because it is a rough environment in which to live.

One of the easiest ways to measure the pH of a substance is to use a *pH indicator*. Litmus is a paper coated with an indicator that turns red in an acid and blue in a base. Other pH indicators have a whole range of colors—one for every number on the pH scale. There are also pH indicators that can be found in nature. The juice produced by boiling red cabbage is useful for determining pH. A very acidic solution will turn red cabbage juice red. Neutral solutions appear purple and basic solutions turn a greenish-yellow when cabbage juice is added.

### TASK:

1. Place a small amount of one liquid to be tested in a clean glass container.
2. Take a strip of red litmus paper and dip one end into the liquid. Record any color change.
3. Repeat the test using a strip of blue litmus paper. Once again, record your results.
4. Repeat steps 1, 2, and 3 for all of the liquids that your teacher gives you to test. Remember, the glass container must be clean.
5. You have tested the substances. Now classify the substances according to the characteristics of acid, base, or neutral.
6. Copy the information from your **DATA TABLE** on the chalkboard so that other students can record your data.
7. From the blackboard, copy information about other substances tested by other students.



## Student Sheet 4

### Analysis:

1. What is the pH of pure water?
2. What do acidic solutions have high concentrations of?
3. On the pH scale, where can you find the strong acids and the strong bases?
4. What is the range of the pH scale?
5. What is the pH of a neutral solution?
6. A map of the eastern US, showing the pH of rainfall in various states, indicates that the pH of rain in NY State is 4.22-4.40. According to this information, what is the pH the most acidic rainfall in NY State?
7. What is the value used to express the acidity or alkalinity of a solution?
8. What are compounds called that form  $H^+$  ions when dissolved in water?
9. What is a solution called that has more  $OH^-$  ions  $H^+$  ions?
10. Bleach has a pH of around 12. What is it considered on the pH scale?
11. Glucose has a pH of 7. What does that tell you about the number of  $H^+$  and  $OH^-$  ions it has?
12. When cranberry juice breaks down it releases more  $H^+$  ions than  $OH^-$  ions. Where does that rank cranberry juice on the pH scale?
13. Milk has a pH of 6.8. Is it slightly base or slightly acidic?
14. What is the correct chemical name for vinegar?
15. What substance changes color when exposed to an acid or base?
16. What is the pH of strong acids on the pH scale?
17. A solution with a pH of 9 is ten times more acidic than what pH value?
18. What is the simplest way to test the pH of a solution?
19. If a pH indicator turns blue when added to a substance, what type of substance is it?
20. Does a solution at pH 4 have more or less hydrogen ions than the same amount of another solution at pH 8?